

SUMMARY POINTS FROM ORGANIC CARBON DRINKING WATER WORKSHOP, AUGUST 26 & 27, 1999

General Points of Agreement

Following is perhaps an overly-simplified list of points from the workshop about organic carbon that seemed to have general agreement.

- Rivers, island discharge, and in-channel processes all contribute to DOC in the Delta withdrawals and at the export facilities. The relative importance of each at any given time depends on
 - water year
 - season
 - timing of exports and sources
 - river flows
 - tides

River sources of organic carbon appear to dominate in the winter. Biological processes (phytoplankton) in the Delta appear to dominate in the spring and summer.

- DOC varies considerably in quality. It is a complex heterogenous mixture of different molecular weights, solubilities, polarities, reactivities, labile to refractory compounds.
- DOC quality varies considerably among sources.
- DOC in Delta channels is not a simple mixture of DOC from the rivers and DOC in the agricultural drains
- The quality of the DOC is as important as the quantity in affecting THMFP in exports.
- TOC and SUVA are used as surrogates for THMFP because they correlate with each other. Because the quality of DOC varies considerably, the relationship between these surrogates and THMFP has considerable variability and involves several assumptions. In addition there are other haloacetic acids formed that could be of concern that are not measured by THMFP. This may affect accurate estimation of THMFP & other DBP formation to some degree and obscure some of the details of what is occurring.

Recommendation for a Technical Group

The workshop participants recommended that a Technical Group of agency and stakeholders be formed who are tasked with:

- A. Analysis of existing historical data to establish baseline conditions, characterize organic carbon sources, resolve issues and outline the "big picture".
- B. Define worst-case conditions for which treatment facilities will have to prepare
- C. Develop additional monitoring and analysis to resolve questions that cannot be answered by the historical analysis
- D. Identify technical studies needed to bound uncertainty as well as identifying where levels of uncertainty are acceptable (i.e., prioritizing information needs)
- E. Increase predictive capabilities relative to consequences of wetland restoration activities on organic carbon

F. Develop and execute experiments with Delta water mixtures to assess DBP formation

G. Identify and consult with experts in the wetlands field to scope out issues relative to designing wetlands to improve water quality

The technical group should integrate and coordinate with other components of CALFED such as the Integrated Storage Investigation, coordinate with existing agency efforts, and maintain awareness of the recent advances in drinking water treatment methodologies.

It was pointed out that CALFED is creating a Drinking Water Constituents Work Group that will be forming in early October. The concern was raised that creating too many committees and work groups is inefficient. Workshop participants agreed that the Drinking Water Constituents Work Group or a sub-group thereof could potentially meet the needs of the "technical group" recommended by the workshop.

Draft summary of research needs .

Following is a summary of various research needs and uncertainties expressed by workshop speakers and participants. The list is not prioritized. Not all the items mentioned have agreement that they are a *priority* research need.

Quantity & Quality of organic carbon

- A better understanding is needed of organic carbon loading amount, quality, reactivity & variability from all sources throughout the year and the processes that affect them, including
 - rivers
 - sewage treatment plants discharge
 - wetlands
 - channel processes, non-point sources such as algae and macrophytes,
 - agricultural drains
 - * peat soil vs. crop residue contributions
 - * effects of different agricultural practices: grazing, crops, dairy operations
 - urban runoff & increasing urbanization
 - boat waste
- A good conceptual model and simulation modeling of organic carbon source loadings, sinks, and processes in the system is needed. A regional viewpoint as well as a local view point is needed.
- An improved understanding of water year effects, water operations and facilities on variability of DOC in the system is needed. What amount of organic carbon as a percentage of the whole amount in the Delta is exported?
- A number of studies have measured organic carbon in various source waters. An understanding is needed of how organic concentrations in these various sources relate to loads.
- An understanding of spatial and temporal variability of organic carbon loading is needed.
- Organic carbon issues must be coupled with Delta hydrology modeling to better understand their importance in affecting drinking water. If DOC is released at

different points in the system, what is the probability that it will affect reactive DOC concentrations at the export facilities? A good validated hydrology model is needed.

- A 1-2 year mass balance study is needed that measures quantity and quality of DOC throughout that period, similar to DWR's DIDI report
- Agricultural drainage should be investigated as a source of bromide, e.g. data from Empire tract represents geologically trapped seawater
- DOC quality should be further investigated as it degrades/is converted from one type to the next in Delta channels and outside Delta channels (as it travels through the aqueducts).

Organic Carbon for Drinking Water vs. Food Web

- The types of organic carbon that are more useful biologically versus the types that affect drinking water quality are unclear. Are they the same or different? POC appears more important biologically and DOC more important for drinking water quality, but this needs research on a sub-regional as well as regional basis. In general, river water is recalcitrant and less useful biologically whereas autochthonous material is more useful. Would removal of DOC to benefit drinking water affect the food web?
- What effect will increasing wetland acreage in Delta have on DOC at export facilities? Can wetlands be placed in locations where the impact on DOC at export facilities will be less?
- All wetlands are not the same. Wetlands can even be designed to improve water quality by acting as sediment traps and heavy metal traps. Can wetlands be designed to improve water quality as defined by reducing DBPs?
- How do marsh plants affect DOC concentrations and loadings?
- What concentration and quality of DBP precursors are exported from different types of wetlands, how do they affect drinking water quality at the export facilities and how do they affect delta and estuarine food webs?

Drinking Water Quality Issues

- Laboratory experiments with various Delta water mixtures should be developed and executed to assess DBPs formed
- The effects of DOC quality and quantity on SUVA and THMFP need to be separated
- Simple surrogates such as SUVA and TOC that moderately correlate with THMFP should be replaced by surrogates that better reflect the most reactive organic matter forms that affect drinking water and more tightly correlate with THMFP and DBPs.
- What are the DOC precursors of DBP other than THM?
- More comprehensive total organic halogen measures are needed that measure not only THMFP but also haloacetic acid measures, total organic halogen compounds, etc. Haloacetic acid analyses are needed to better understand the reactivity of natural organic matter to form DBPs of health and regulatory concern. Otherwise only a narrow understanding of the DOC-DBP relationship is achieved.
- What is the usefulness of UV disinfection as an alternative to chlorination? (a speaker pointed out that it won't meet all needs)
- What is the worst case scenario that the export facilities must be prepared for?

- The economics of treating at the plant vs. the tap might be evaluated since only a small portion of the water is being used as drinking water. However, our laws require treatment at the plant.
- What would be the treatment cost per year of treating water in Clifton Court Forebay (in contrast to treating agricultural drainage water)
- Retain consideration of all CALFED alternatives when looking for ways to improve drinking water quality
 - consideration of all 3 alternatives identified by CALFED
 - cost analysis of treatment at exports vs. treatment plant
 - seasonality of pumping
 - holding water on islands
 - identification of what can and cannot be done to decrease organic carbon in exports

Monitoring Methods

- An evaluation of the monitoring being conducted is needed, i.e. long-term monitoring of lots of sites for a few parameters vs. very detailed studies of a few sites